Remarks

The Applicants have amended Claims 2 and 4 to provide appropriate antecedent basis for the "weld heat affected zone." Claim 2 has also been amended to recite that the amount of V is the same as Claim 4. Entry of the above changes into the official file is respectfully requested.

Claims 2-5, 7-10, 12-15 and 17-20 stand rejected under 35 USC §103 over Kimura; Claims 2-5, 7-10, 12-15 and 17-20 stand rejected under 35 USC § 103 over JP '604; and Claims 2, 3, 7, 8, 12, 13, 17 and 18 stand rejected under 35 USC §103 over Ueda. The Applicants note with appreciation the Examiner's detailed comments applying those three references against the three respective sets of claims. The Applicants nonetheless respectfully submit that all of Kimura, JP '604 and Ueda fail to disclose, teach or suggest the subject matter of those claims. Details follow.

Starting with the rejection based on Ueda, the Applicants note that Ueda frankly acknowledges that there is no disclosure of V in any quantity. However, independent Claim 2 specifically recites 0.02% to 0.1% of V. Given the failure to disclose, teach or suggest the presence of any amount of V, the Applicants respectfully submit that Ueda is nonenabling with respect to this claimed aspect and, therefore, Ueda is inapplicable to any of Claims 2, 3, 7, 8, 12, 13, 17 and 18. Withdrawal of the rejection on this basis alone is respectfully requested.

The Applicants respectfully submit that all of Kimura, JP '604 and Ueda fail to disclose, teach or suggest the Applicants' claimed amount of C_{sol} of less than 0.0050% as recited in Claims 2 and 4. Thus, the Applicants respectfully submit that all three references are inapplicable under §103. However, the Applicants will provide detailed comments with respect to why the three references are inapplicable in conjunction with enclosed Figs. A, B and C, as well as three pages

of Examples drawn from the Applicants' specification and the specifications of the three references.

As evidence to show the relationships between Examples disclosed in Kimura, JP '604, Ueda and the Applicants' Claim 2, the Applicants enclose the above-mentioned Figs. A, B and C. The ranges in yellow are outside the range defined in Claims 2 and 4. In particular, concerning C_{sol}, all of the Examples of Kimura and JP '604 deviate extensively from the range of the content C_{sol} of less than 0.0050% defined by Claims 2 and 4. Further, of the 62 Examples of Ueda, merely two Examples, No. 1 and No. 54, satisfy the range of the content C_{sol} of less than 0.0050% defined by Claims 2 and 4. In any event, however, the V content of Example No. 1 is out of the V range of Claim 2, while Example No. 54 includes Ni and N in amounts outside the ranges of Ni and N of Claims 2 and 4. The N contents of all of the Examples of Kimura are outside the range of N defined in Claims 2 and 4. The N contents of most of the Examples of JP '604 and Ueda are outside the N content range of Claims 2 and 4.

From the above, those skilled in the art can readily glean that Claims 2 and 4 can hardly be obtained from the disclosures of Kimura, JP '604 and Ueda. In particular, it is difficult to obtain the specified content C_{sol} in Claims 2 and 4 at less than 0.0050%. The technical concept of the content C_{sol} at less than 0.0050% in Claims 2 and 4 is included in the Applicants' specification from line 6 of page 4 to line 15 on page 5. However, an additional explanation will be given with the assistance of the attached Figs. A to C.

Carbides (green circles of (1) in the attached Fig. A) dispersed in a matrix are dissolved into matrix during a welding thermal cycle (the initial thermal cycle of the upper right thermal cycles) and Cr carbide precipitates (3) prior-austenite grain boundaries during following welding thermal cycles to cause the formation of Cr depleted zones (A-A' in (3) of Fig. A) around the

prior-austenite grain boundaries. Hence, IGSCC occurs. Thereafter, according to known methods as described in the Applicants' specification from line 8 from the bottom of page 3 to line 1 on page 4, to prevent Cr depleted zones from being formed and to suppress the occurrence of IGSCC, post-welding heat treatment (PWHT) at 600 to 660°C is conducted. ((4) and A-A' in the attached Fig. A.)

Fig. B exhibits the Applicants' concept. The Applicants secure resistivity of higher IGSCC than that of a steel type containing lesser alloy components in the base components of 12Cr-5Ni-2MO containing much alloy components. To accomplish the foregoing, as the bottom right drawing (Target) shows, it is critical to prevent Cr carbide from being formed at prior-austenite grain boundaries and the effective content C_{sol} of dissolved carbon that affects the formation of Cr carbide must therefore be reduced to less than 0.0050% by mass in such a manner that the C content is extremely reduced (down-pointing arrow in the drawing) or the content of a carbide-forming element such as Ti, Nb, V, or Zr, having higher ability to precipitate carbides than that of Cr is increased (right-pointing arrow in the drawing).

Nonetheless, this concept is not disclosed, taught or suggested in Kimura, JP '604 and Ueda.

Fig. C shows a conceptual diagram of textures of the weld heat affected zones of conventional steel (e.g., the three references) and a conceptual diagram of the subject matter of Claim 2. It is understood in the diagram of Claim 2 that the Cr depleted zone is reduced to a level whereas IGSCC is substantially out of the question.

From what has been discussed above, the subject matter of Claims 2 and 4 provides an unexpected effect of suppressing the intergranular stress corrosion cracking (IGSCC) without applying, after welding, heat treatment to even martensitic stainless steel.

The Applicants therefore respectfully submit that when the disclosures of Kimura, JP '604 and Ueda are taken in their entirety, there is a complete failure in each instance to disclose, teach or suggest the Applicants' claimed C_{sol} amount of 0.0050% or less. Moreover, the Applicants respectfully submit that there are no teachings or suggestions in the three respective references that would cause one skilled in the art to modify those references to bring about such a claimed amount of C_{sol}. Further, the Applicants respectfully submit that all three references are devoid of teachings or suggestions that would lead one skilled in the art to have a reasonable expectation that any modifications would or could result in such a claimed amount of C_{sol}. Withdrawal of all three rejections is accordingly respectfully requested.

In light of the foregoing, the Applicants respectfully submit that the entire application is now in condition for allowance, which is respectfully requested.

Respectfully submitted,

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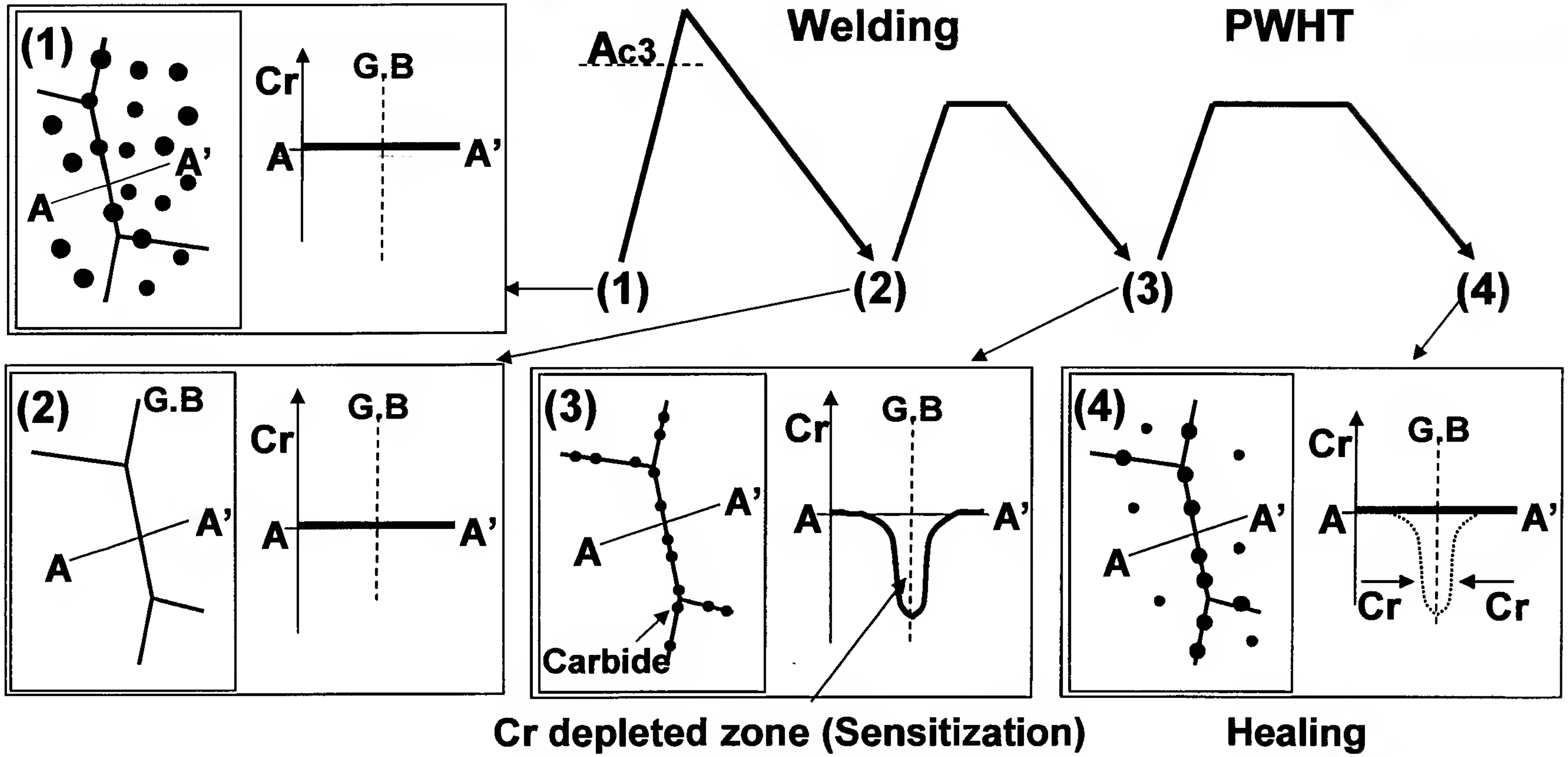
Fig.A: Mechanism of IGSCC



(1) Before welding: Carbides are present in both matrix and grain boundary
(2) Welding (High temperature pass): Carbon is dissolved into austenite matrix
(3) Welding (Following pass): Cr carbides re-precipitate along prior austenite grain boundary and Cr depleted zone is formed on the grain boundary adjacent to the carbides (in case of some specific conditions)
(4) PWHT: Cr depleted zone is healed due to Cr diffusion

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Fig.B: Concept of improvement in IGSCC resistance

Base grade: Rich grade(12Cr-5Ni-2Mo)

- **Higher resistance to IGSCC than lean grade**

Compositions:

- **Reduction in C**
  (to reduce dissolved carbon)
- **Addition of Ti、Nb、V、Zr**
  (to substitute Cr carbide to carbide of another element)

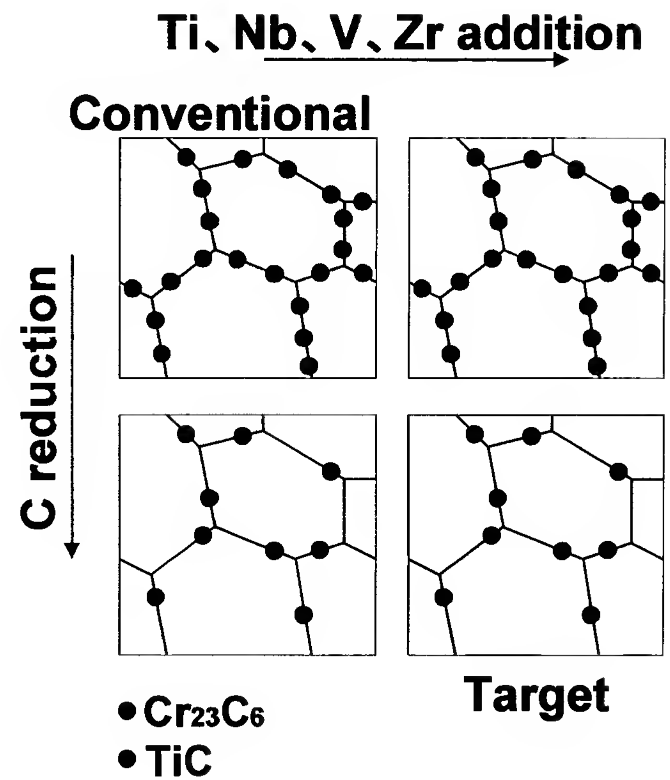

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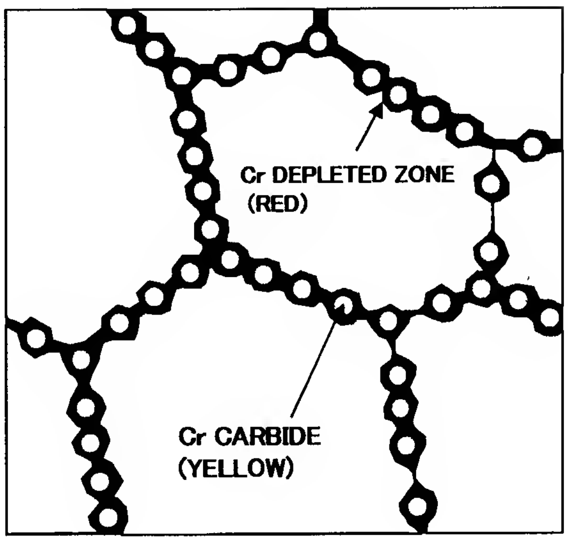
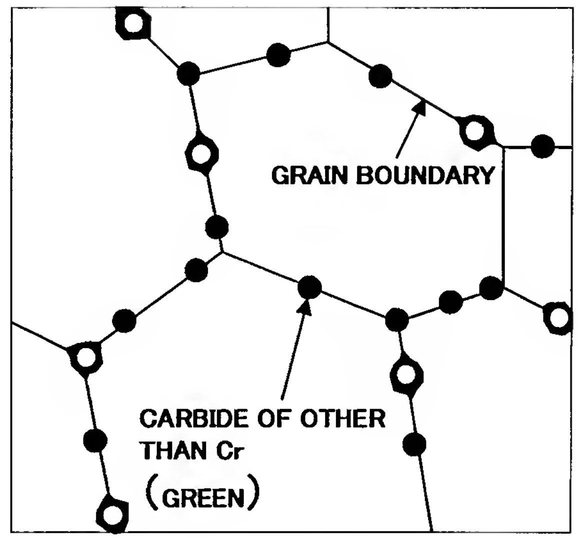
Fig. C: Comparison of welded heat affected zone

CONVENTIONAL STEEL



STEEL OF INVENTION



Cr DEPLETED ZONE IS
DECREASED TO A LEVEL OF
OUT OF QUESTION

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omparative Table

outside the range of the amended claim 4

e range of the amended claim 4

	C	Si	Mn	P	S	Cr	Ni	Al	N	Mo	Cu	Co	W	Ti	Nb	V	Zr	Ca	Hf	Ta	Mg	REM	B	O	C-sol
wer limit		0.05	0.1			10	3	0.001								0.02		0.0005							
per limit	0.01未満	1.0	2.0	0.03	0.010	14	8	0.10	0.01未満	4	4	4	4	0.15	0.10	0.10	0.10	0.010	0.20	0.20					0.0050

US5985209

.	C	Si	Mn	P	S	Cr	Ni	Al	N	Mo	Cu	Co	W	Ti	Nb	V	Zr	Ca	Hf	Ta	Mg	REM	B	O	C-sol
	0.010	0.25	0.44			12.10	3.86	0.02	0.024	1.02	0.49														0.0169
	0.014	0.25	0.47			12.9	4.06	0.02	0.047	0.95															0.0274
	0.013	0.24	0.45			13.1	1.15	0.02	0.025	0.52	0.50				0.047										0.0191
	0.005	0.25	0.45			12.2	5.12	0.02	0.010	2.02							0.016								0.0075
	0.009	0.25	0.44			10.7	1.47	0.02	0.015	1.55															0.0133
	0.008	0.23	0.46			11.2	1.18	0.02	0.023	0.91	0.51									0.031					0.0143
	0.014	0.21	0.51			11.0	0.80	0.02	0.031	1.47	0.24							0.002							0.0229
	0.016	0.20	0.50			11.9	3.95	0.02	0.011	2.24				0.022											0.0173
	0.007	0.20	0.50			11.5	3.53	0.01	0.012	1.56						0.012									0.0101
	0.019	0.21	0.51			12.1	4.07	0.02	0.011	1.93				0.043	0.015										0.0182
	0.008	0.19	0.49			11.8	4.79	0.03	0.015	3.95					0.020		0.035								0.0111
	0.027	0.21	1.49			11.8	0.99	0.02	0.026	0.38	0.58														0.0344
	0.012	0.19	1.51			11.9	0.98	0.02	0.053	1.14															0.0271
	0.011	0.20	1.53			9.2	1.20	0.03	0.012	0.90															0.0144
	0.012	0.19	1.50			13.1	0.75	0.02	0.011	0.37	0.45				0.025										0.0146
	0.011	0.22	1.48			12.1	0.01	0.02	0.013	0.91															0.0147
	0.019	0.19	1.51			11.9	1.66	0.02	0.055	1.43															0.0347
	0.010	0.22	1.49			10.5	1.39	0.02	0.013	1.22					0.014										0.0134
	0.015	0.23	1.49			11.7	1.10	0.03	0.011	0.37															0.0181
	0.019	0.19	1.50			11.1	0.89	0.02	0.012	0.11															0.0224
	0.014	0.22	0.45			12.3	4.26	0.02	0.024	0.89					0.010	0.062									0.0190
	0.010	0.25	0.47			12.3	3.86	0.02	0.047	1.01	0.24					0.094									0.0210
	0.010	0.23	0.42			12.2	2.25	0.02	0.025	0.96				0.047	0.016	0.052									0.0115
	0.006	0.24	0.43			13.2	4.31	0.02	0.026	2.15						0.066	0.016								0.0113
	0.013	0.25	0.44			12.2	5.16	0.02	0.015	1.81						0.054									0.0159
	0.011	0.23	0.49			12.6	2.42	0.02	0.023	0.89	0.51				0.038	0.042				0.031					0.0154
	0.009	0.24	0.42			12.6	4.55	0.02	0.031	1.60	0.24				0.042	0.05		0.002							0.0156
	0.015	0.23	0.46			12.7	3.56	0.02	0.011	0.84				0.022		0.1									0.0137
	0.008	0.23	0.48			12.3	3.75	0.02	0.012	1.44					0.023	0.074	0.012								0.0087
	0.011	0.25	0.53			12.7	4.51	0.02	0.011	1.52				0.043	0.043	0.066		0.005							0.0079
	0.010	0.23	0.49			11.8	5.59	0.02	0.015	2.63						0.119									0.0112
	0.008	0.21	0.53			11.9	0.76	0.02	0.056	0.38	0.58				0.057	0.047									0.0215
	0.012	0.24	0.44			11.9	2.65	0.02	0.053	1.14					0.007	0.064									0.0253
	0.011	0.25	0.43			9.5	2.51	0.02	0.012	0.06					0.006	0.009									0.0141
	0.012	0.22	0.50			12.2	3.28	0.02	0.011	0.37	0.45			0.025	0.035	0.026									0.0116
	0.011	0.22	0.49			12.3	0.81	0.02	0.013	0.41					0.004	0.01									0.0144
	0.019	0.27	0.51			12.1	4.62	0.01	0.065	1.43					0.020	0.066									0.0354
	0.020	0.22	0.50			10.3	3.42	0.02	0.013	1.22				0.014	0.018	0.12									0.0190

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	0.015	0.21	0.57			11.8	1.38	0.03	0.011	0.37					0.076	0.066									0.0148
	0.019	0.20	0.52			12.4	0.96	0.02	0.012	0.11					0.007	0.044									0.0211

JP2002-105604A

	C	Si	Mn	P	S	Cr	Ni	Al	N	Mo	Cu	Co	W	Ti	Nb	V	Zr	Ca	Hf	Ta	Mg	REM	B	O	C-sol
	0.012	0.31	1.35	0.02	0.001	12.6	5.12	0.02	0.014	1.86															0.0160
	0.011	0.51	1.08	0.02	0.001	12.4	4.86	0.02	0.021	1.67					0.024	0.033									0.0156
	0.009	0.31	1.28	0.02	0.001	11.8	3.19	0.02	0.014	1.99				0.047											0.0091
	0.008	0.22	1.43	0.01	0.001	12.1	4.31	0.02	0.008	1.98						0.016	0.016			0.011					0.0095
	0.010	0.21	1.04	0.02	0.002	12.2	4.59	0.01	0.012	1.86															0.0134
	0.011	0.29	1.39	0.01	0.001	11.9	5.33	0.02	0.018	2.35															0.0161
	0.010	0.25	1.55	0.01	0.001	12.8	4.55	0.02	0.008	1.78						0.027									0.0116
	0.012	0.32	1.31	0.02	0.001	11.8	3.74	0.02	0.019	0.01															0.0174
	0.011	0.33	1.38	0.02	0.002	9.8	4.29	0.02	0.023	2.06					0.011	0.047									0.0161
	0.014	0.28	1.26	0.01	0.001	12.6	2.51	0.02	0.009	1.39				0.025											0.0145
	0.031	0.31	1.28	0.02	0.002	12.1	3.92	0.02	0.012	1.59															0.0344
	0.012	0.29	1.06	0.01	0.002	12.0	0.14	0.02	0.009	1.41															0.0146
	0.009	0.30	1.19	0.01	0.001	12.3	4.35	0.02	0.075	1.66															0.0304
	0.014	0.24	1.24	0.01	0.002	11.6	4.66	0.02	0.016	1.73				0.039											0.0153

EP1026273A

	C	Si	Mn	P	S	Cr	Ni	Al	N	Mo	Cu	Co	W	Ti	Nb	V	Zr	Ca	Hf	Ta	Mg	REM	B	O	C-sol
	0.005	0.36	0.55	0.013	0.005	11.2	3.5	0.10	0.008	0.5				0.03											0.0048
	0.008	0.11	0.15	0.012	0.001	7.1	1.1	0.07	0.008					0.02											0.0086
	0.006	0.17	0.25	0.009	0.001	9.2	2.0	0.15	0.010								0.02								0.0084
	0.014	0.25	0.20	0.010	0.001	10.5	3.0	0.05	0.010					0.01											0.0160
	0.003	0.47	0.46	0.016	0.001	13.5	5.8	0.11	0.020					0.02											0.0070
	0.011	0.59	0.76	0.016	0.002	11.5	5.2	0.06	0.020	1.0				0.05			0.01								0.0123
	0.010	0.91	1.40	0.010	0.003	10.3	4.1	0.07	0.010				1.0	0.06								0.006			0.0078
	0.009	0.05	0.33	0.025	0.002	12.7	5.5	0.05	0.020	1.0			1.0	0.03							0.007				0.0122
	0.005	0.29	0.67	0.011	0.001	11.5	5.0	0.12	0.010					0.02				0.01							0.0062
	0.008	0.55	0.47	0	0.001	7.5	1.5	0.03	0.008					0.03				0.01				0.005			0.0078
	0.011	0.34	1.11	0.015	0.005	12.0	2.0	0.10	0.013					0.02											0.0130
	0.010	0.34	1.08	0.015	0.005	12.2	2.0	0.10	0.013					0.02											0.0120
	0.015	0.24	1.08	0.015	0.003	12.3	1.8	0.09	0.014					0.03											0.0165
	0.025	0.34	1.09	0.015	0.003	12.6	1.9	0.09	0.022					0.03											0.0288
	0.023	0.35	1.11	0.015	0.003	12.9	1.5	0.09	0.013					0.05											0.0225
	0.013	0.36	1.11	0.015	0.003	12.3	1.9	0.09	0.011					0.03											0.0136
	0.010	0.31	1.10	0.027	0.004	11.8	1.8	0.09	0.008					0.02											0.0106
	0.012	0.33	1.09	0.024	0.003	11.7	1.8	0.08	0.008					0.02											0.0126
	0.028	0.31	1.97	0.011	0.005	12.1	2.1	0.10	0.010					0.02											0.0292
	0.005	0.31	1.99	0.004	0.004	11.9	1.8	0.11	0.010					0.03											0.0054
	0.005	0.09	1.11	0.016	0.006	7.2	6.7	0.15	0.010					0.01											0.0070
	0.005	0.24	1.07	0.012	0.006	10.1	6.7	0.15	0.012					0.01											0.0076
	0.014	0.34	1.08	0.012	0.005	14.1	2.1	0.05	0.012					0.03											0.0149
	0.005	0.40	1.09	0.011	0.006	7.5	5.8	0.15	0.013					0.01			0.02								0.0074

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	0.007	0.63	1.10	0.009	0.006	9.5	5.5	0.13	0.013					0.01											0.0099
	0.019	0.56	0.19	0.015	0.002	12.4	0.9	0.05	0.027					0.07											0.0209
	0.020	0.70	0.19	0.014	0.002	12.4	1.0	0.04	0.027					0.07											0.0219
	0.022	0.91	0.15	0.014	0.002	12.5	0.7	0.10	0.032					0.09											0.0236
	0.024	0.34	0.13	0.015	0.002	12.7	0.7	0.11	0.027					0.09											0.0242
	0.010	0.34	1.15	0.005	0.009	12.1	2.1	0.17	0.013					0.03											0.0112
	0.009	0.36	1.19	0.007	0.008	11.8	2.1	0.17	0.008					0.03											0.0088
	0.009	0.65	1.21	0.011	0.008	11.8	2.0	0.04	0.008	1.0				0.03											0.0088
	0.020	0.71	1.34	0.015	0.008	8.0	7.0	0.04	0.014	1.95	0.20			0.02											0.0223
	0.008	0.71	1.34	0.015	0.007	12.7	2.2	0.04	0.013				0.5	0.02			0.08								0.0083
	0.011	0.24	1.11	0.013	0.007	12.5	4.9	0.07	0.012				2.7	0.02											0.0128
	0.010	0.24	1.08	0.016	0.005	12.5	1.5	0.07	0.012	0.10			0.5	0.05											0.0093
	0.038	0.24	1.05	0.012	0.005	7.5	7.9	0.02	0.033	1.85			0.5	0.05											0.0433
	0.010	0.91	1.36	0.011	0.003	10.3	4.1	0.05	0.033				1.0	0.04								0.005			0.0161
	0.009	0.45	0.25	0.011	0.003	11.5	5.7	0.05	0.028	1.00				0.05				0.01							0.0128
	0.009	0.05	0.33	0.02	0.003	12.7	5.5	0.03	0.013	1.00			1.0	0.03							0.007				0.0102
	0.005	0.29	0.67	0.011	0.001	12.5	4.8	0.12	0.013					0.02								0.005			0.0070
	0.010	0.83	0.58	0.015	0.002	7.2	7.9	0.01	0.021	2.10				0.05				0.01				0.005			0.0118
	0.011	0.29	1.08	0.012	0.005	11.9	2.0	0.10	0.022						0.01										0.0171
	0.013	0.25	1.11	0.015	0.003	12.3	2.2	0.09	0.037		0.40				0.051										0.0225
	0.017	0.28	0.50	0.029	0.001	11.7	5.5	0.11	0.021					0.03											0.0205
	0.013	0.79	0.25	0.017	0.002	12.8	5.0	0.02	0.022	1.50							0.05								0.0182
	0.008	0.20	0.37	0.021	0.001	9.5	3.5	0.25	0.018	0.50			0.5	0.07											0.0073
	0.021	0.35	1.11	0.015	0.005	12.3	2.0	0.10	0.034					0.01											0.0299
	0.023	0.35	1.11	0.015	0.004	12.1	2.1	0.10	0.034					0.01											0.0319
	0.019	0.33	1.08	0.015	0.004	11.9	2.1	0.09	0.028					0.01											0.0262
	0.025	0.34	1.07	0.015	0.006	12.3	1.9	0.09	0.028					0.03											0.0305
	0.021	0.34	1.08	0.015	0.003	12.3	1.9	0.12	0.028					0.03											0.0265
	0.007	0.35	0.94	0.015	0.004	12.6	0.1	0.12	0.017	1.20				0.07											0.0060
	0.005	0.35	0.94	0.015	0.004	12.5	0.2	0.09	0.012	0.84				0.07											0.0026
	0.008	0.33	0.97	0.015	0.004	12.7	0.5	0.11	0.012	0.99				0.03											0.0089
	0.013	0.33	1.50	0.028	0.005	12.2	1.9	0.11	0.011					0.02											0.0145
	0.015	0.35	1.61	0.022	0.004	11.8	1.8	0.10	0.012					0.03											0.0159
	0.029	0.35	2.40	0.011	0.003	11.7	1.8	0.09	0.008					0.02											0.0296
	0.038	0.33	2.60	0.007	0.003	12.2	2.1	0.09	0.009					0.02											0.0389
	0.043	0.24	2.65	0.016	0.001	12.5	1.9	0.04	0.013					0.07											0.0409
	0.012	0.25	1.01	0.013	0.002	6.5	2.0	0.08	0.013					0.01											0.0146
	0.003	0.25	1.01	0.011	0.002	15.2	0.8	0.19	0.011					0.09											-0.0014